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Optimized O'Neill/Glaser Model for Human Population of Space and its Impact on Survival Probabilities

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Abstract. Two contemporary issues foretell a shift from our historical Earth based industrial economy and habitation to a solar system based society. The first is the limits to Earth's carrying capacity, that is the maximum number of people that the Earth can support before a catastrophic impact to the health of the planet and human species occurs. The simple example of carrying capacity is that of a bacterial colony in a Petri dish with a limited amount of nutrient. The colony experiences exponential population growth until the carrying capacity is reached after which catastrophic depopulation often results. Estimates of the Earth's carrying capacity vary between 14 and 40 billion people. Although at current population growth rates we may have over a century before we reach Earth's carrying limit our influence on climate and resources on the planetary scale is becoming scientifically established. The second issue is the exponential growth of knowledge and technological power. The exponential growth of technology interacts with the exponential growth of population in a manner that is unique to a highly intelligent species. Thus, the predicted consequences (world famines etc.) of the limits to growth have been largely avoided due to technological advances. However, at the mid twentieth century a critical coincidence occurred in these two trends – humanity obtained the technological ability to extinguish life on the planetary scale (by nuclear, chemical, biological means) and attained the ability to expand human life beyond Earth. This paper examines an optimized O'Neill/Glaser model (O'Neill 1975; Curreri 2007; Detweiler and Curreri 2008) for the economic human population of space. Critical to this model is the utilization of extraterrestrial resources, solar power and spaced based labor. A simple statistical analysis is then performed which predicts the robustness of a single planet based technological society versus that of multiple world (independent habitats) society.

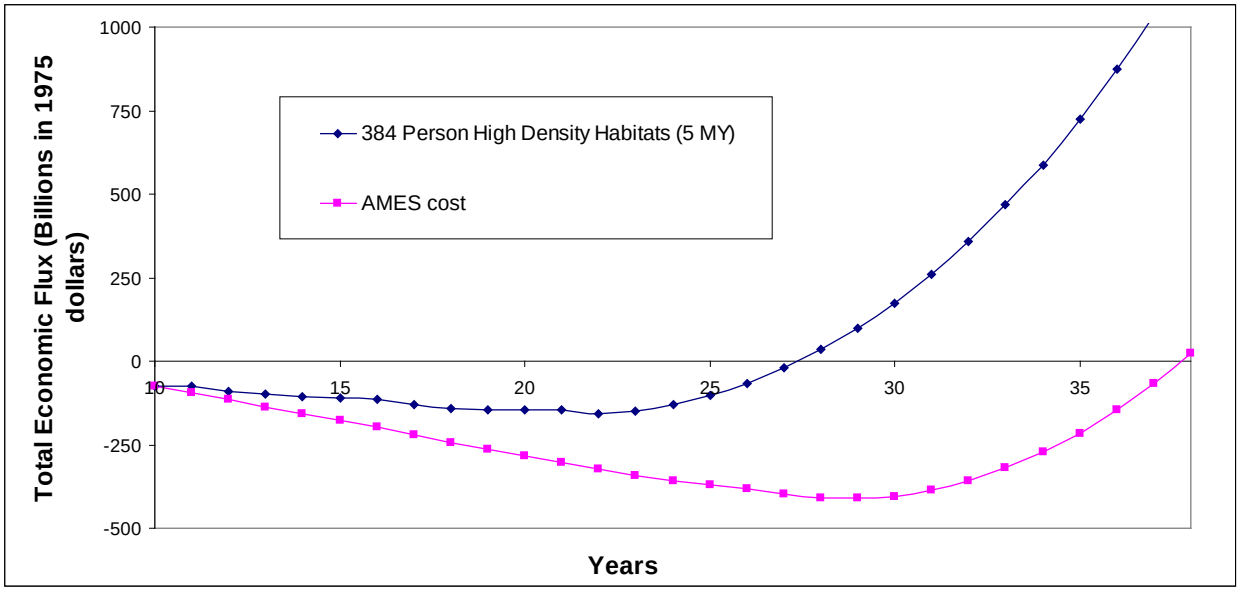

Figure 1. Net Present Value Curve for Space Solar Power and Habitat development showing classical O'Neill, Glaser Model (NASA Ames 1975) and model with optimized habitat size

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